AERIAL OBSERVATIONS OF LARGE ZIPHIID WHALES, POSSIBLY *BERARDIUS ARNUXII*, OFF THE SOUTHERN COAST OF NEW SOUTH WALES

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Large ziphiid whales incidentally observed during tuna-spotting operations on the continental slope of the NSW coast between 34°-37°S are tentatively identified as *Berardius arnuxii*. Morphology, school structure, location and month of sighting are compared with available data for the species together with those for *B. bairdii*, its sole congener, which is confined to the North Pacific Ocean. □ *Large ziphiids, aerial observation, New South Wales.*

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Detailed accounts of behaviour and school structure of ziphiids are limited with the exception of *Berardius bairdii* and *Hyperoodon ampullatus*, exploited species found in the North Pacific and North Atlantic Oceans respectively. Details are reported here of large ziphiids, tentatively identified as *Berardius arnuxii*, incidentally observed off the southern New South Wales (NSW) coast by one of us (AEP) while employed as a tuna-spotting pilot between 1961 and 1987.

OBSERVATIONS

The data are summarised (Table 1) with the exception of a sighting made during a familiarisation flight in January 1962 (Fig. 1). The absence of sightings between 1963 and 1980 is considered to reflect the timing of flying operations in those years. While catches of the preferred target species (southern bluefin tuna) were substantial, flying in NSW ceased by early December and

FIG. 1. School of large ziphiids off the southern NSW coast, January 1962.

TABLE 1. Sightings of large ziphiid whales off the southern New South Wales Coast.

Date	Time (if applicable)	Position	Number	Estimated length(m)
24.1.81	1400	35°46'S 150°38'E	12	7.5
24.1.81	1435	35°50'S 150°51'E	4	7.5
26.1.81	1445	35°47'S 150°40'E	4 (2 pairs)	4.5 & 6.0
26.1.81	1515	36°06'S 150°30'E	3	
19.11.81		36°36'S 151°37'E	2	5.5-6.0
29.11.81		36°42'S 152°39'E	2	5.5
10.12.81		36°01'S 150°27'E	7-8	6.0
9.1.82		35°22'S 150°58'E	6	6.5
2.1.84		35°25'S 150°53'E	~6	
3.1.84		36°13'S 150°34'E	6	9.5-10.0
7.1.84	0910	36°49'S 150°24'E	>8	
7.1.84	1035	36°50'S 150°24'E	~6	
7.1.84	1240	36°57'S 150°21'E	>8	
9.1.84		35°23'S 150°56'E	~5	
9.1.84	1510	36°00'S 151°09'E	1	6.0
9.1.84	1520	34°52'S 151°17'E	4	7.5-9.0
9.1.84	1600	36°17'S 151°09'E	4	7.5-9.0
11.1.84		35°44'S 150°40'E	6	7.5-9.0
12.1.84		37°05'S 150°25'E		
19.1.84	0940	34°38'S 151°16'E	4	9.0
19.1.84	1050	36°10'S 150°28'E	~6	
23.1.84	1000	35°18'S 151°00'E	4	>9.0
23.1.84	1145	36°38'S 150°23'E	4	9.0
2.2.84	1025	34°32'S 151°24'E	10	7.5-9.0
2.2.84	1030	34°39'S 151°19'E	2	6.0-7.5
2.2.84	1050	35°12'S 151°09'E	9	6.0-7.5
4.2.84		35°42'S 150°45'E	16	7.5-9.0

operations were transferred to South Australia. However, as NSW bluefin catches declined in the early 1980s flights were continued often until March in attempts to locate other tuna species, such as skipjack, believed to be more abundant when sea temperatures were higher (21°-27°C). Flights were restricted in 1983 due to adverse weather and were reduced after 1984 due to further catch decline. AEP ceased flying in the region in 1987.

With few exceptions sightings were made in the relatively narrow area of the continental slope between 34°-37°S (Fig. 2) although flights were made for considerable distances beyond that area. All positions were determined by VLF/Omega navigational equipment. Sighting cues included breaching (Fig. 1), surface splashing and "tight finger" formation (Fig. 3) considered most characteristic of undisturbed activity. The whales usually dived when approached and swam rapidly and unidirectionally for periods of up to twenty minutes beneath the surface while maintaining close formation. This relatively shallow depth of travel was unique amongst all whale species observed by AEP. Fluke raising was not observed on any occasion.

With the exception of two pairs seen on 26.i.81 members of each group were of similar length and calves were not identified. Dorsal scarring and a prominent anterior white area on the rostrum were noted when the whales were at the surface (Fig. 4). They were brown on the dorsum although some were paler perhaps due to more extensive scarring.

IDENTITY

As aerial observation was the only means of inspection the precise identity of these whales remains uncertain but their body length and well-defined rostrum indicate large ziphiids. On the basis of morphology, school structure, location and months of sighting we tentatively conclude that they were *Berardius arnuxii*. In reaching this conclusion reliance has been placed on comparable data, including aerial observations, available for *B. bairdii* the sole congener of *B. arnuxii*, which is confined to the North Pacific Ocean.

MORPHOLOGY

The length estimates are consistent with those of *B. arnuxii* reported by McCann (1975) but they overlap with *Hyperoodon planifrons*, *Mesoplodon layardii*, *Tasmacetus shepherdi*, *Ziphius cavirostris* and probably with *Indopacetus pacificus* which has never been reported in the living state. The "overhanging" melon and relatively short rostrum of *H. planifrons* tend to exclude it as the likely species. However, sightings of *H. planifrons* were reported in the study area at 34°19'S, 151°12'E on 30 February 1988 (Lewis, 1988). The observation that all members of each group were of similar length supports *B. arnuxii* in which adult males and females are of equal length (McCann, 1975). However, segregation of the sexes for *B.*

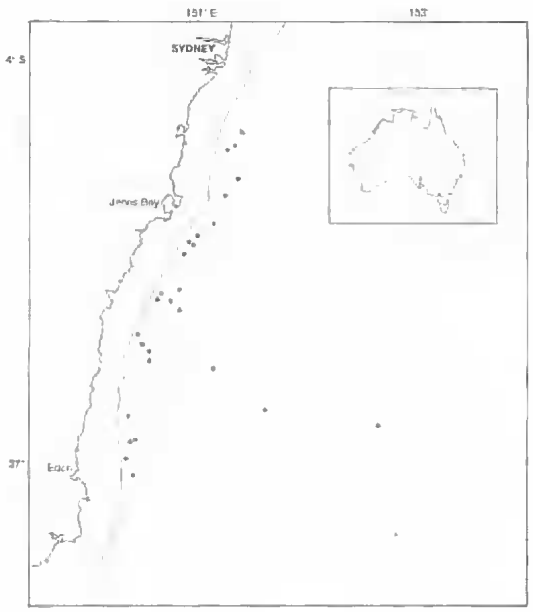

FIG. 2. Map of the southern NSW coast indicating position of large ziphiids from Table 1. The 200m isobath is shown.

bairdii has been noted by Leatherwood et al. (1982) and Baleomb (1989).

In *Berardius*, alone amongst ziphiids, functional anterior mandibular teeth (Fig. 5) erupt in hoth sexes (Moore, 1968). It is likely that the anterior white areas observed in the NSW ziphiids were teeth.

The brown dorsal eolouration is eonsistent with the observations of Baleomb (1989) and with the eolour illustration (MeCann, 1975) of an elderly male *B. arnuxii* stranded at Pukerua Bay, New Zealand. Other eolour deseriptions vary from "dark" to blaek (Hale, 1939; MeCann, 1975). However, those descriptions were of dead or dying animals (although so was the Pukerua Bay specimen) and it is possible that eolour darkened due to terminal or post-mortem ehanges. Loughlin & Perez (1985) state that light eonditions may result in colour variation and note that *Physeter macrocephalus* and *B. bairdii* whieh are neutral grey in eolour appear dark hrown in sunlight and greenish when submerged.

Miyashita (pers. eomm.) considers that the NSW ziphiids belong to the genus *Berardius* beeause inter alia there is evidenee of anterior convex configuration of the blow hole (which is unique amongst ziphiids) best seen in Fig. 6. However, we eonsider that film quality is insufficient to eonfirm such detail absolutely.

SCHOOL STRUCTURE

There is considerable similarity between the sehools identified here and those of *B. bairdii* observed aerially off Japan. Kasuya (1971) noted school size of *B. bairdii* between 1-30 with a mean of 4.5, Shipboard estimates of school size of the same species were 1-25 with a mean of 7.5 (Kasuya, 1986). The NSW sehools ranged between 1-16 with a mean of 5.8. Baleomb (1989) observed a large school of approximately 80 *B. arnuxii* in Robertson Bay, Antaretica in February 1986. That school later split into sub-groups of 8-15. His deseription of elose proximity, dive sequenees and non-raising of the flukes is similar to the NSW observations.

LOCATION AND MONTHS OF OBSERVATION

Previous data from Australasia (Hale, 1939; MeCann, 1975) indieate that most *B. arnuxii* strandings oecur during the summer months of Deeember-March. In addition, a male *B. arnuxii* measuring 10.06m in length stranded at Cape Riehe (34°42'S, 118°36'E) on 1 January 1989. The skull (WAMM29335) is held in the Western Australian Museum. The data in Table 1 are restrieted to summer and *B. bairdii* also exhibits

FIG. 3. School of large ziphiids at 37°05'S, 150°25'E on 12 January 1984. "Tight finger" formation is evident. (Photograph taken from ~500m and subsequently enlarged).

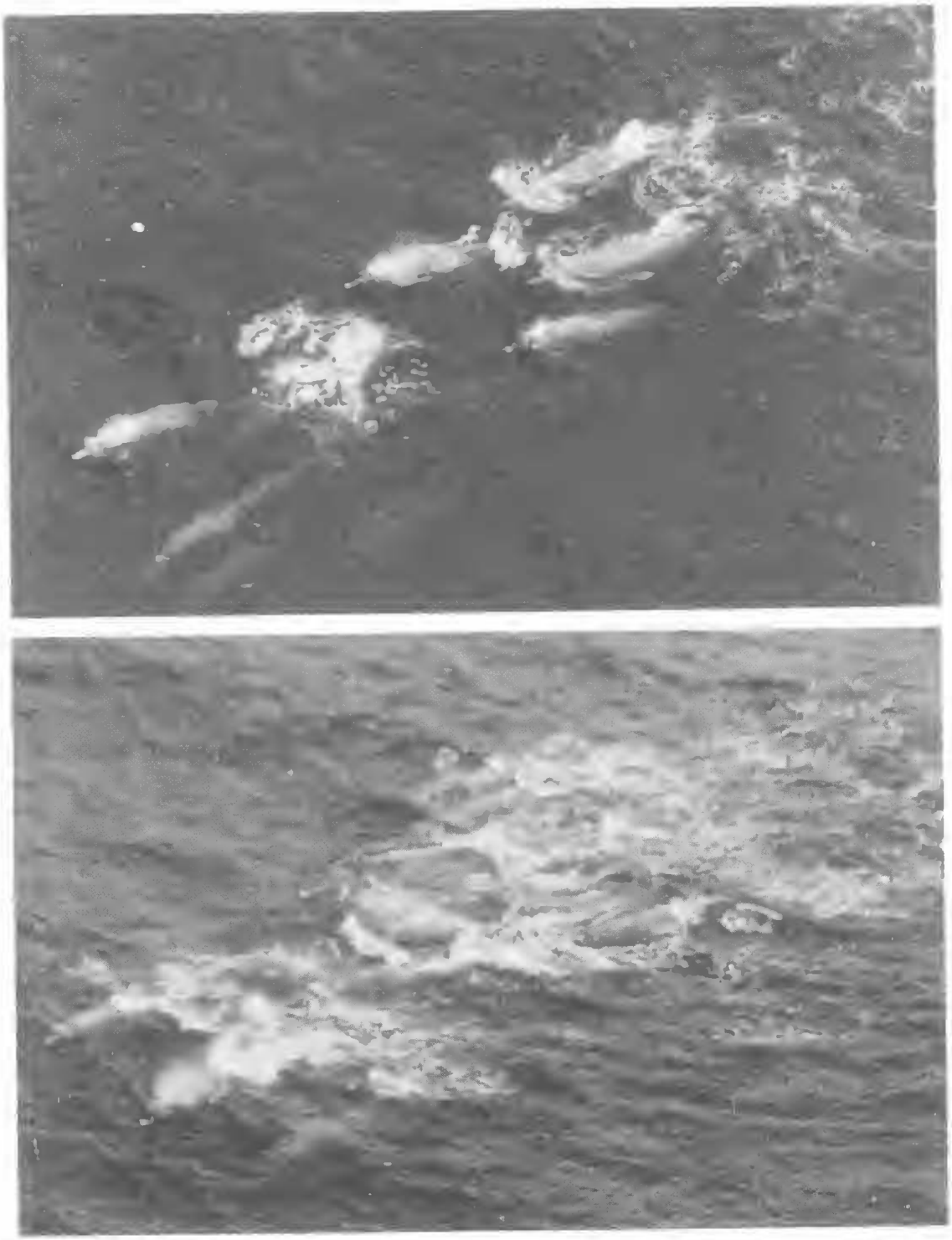

FIG. 4. School of large ziphiids at 35°12'S, 151°09'E on 2 February 1984 showing dorsal scarring and anterior white areas considered to be teeth. Low "bushy" blows are also evident.

FIG. 5. Dentary of *B. arnuxii* (SAMM5012) demonstrating the prominence of the anterior pair of mandibular teeth and the protrusion of the mandible in relation to the rostrum.

a summer peak in Japanese waters (Omura et al., 1955; Nishiwaki & Oguro, 1971) with movement into northern waters during cooler months. Kasuya (1971, 1986) noted absence of *B. bairdii* from Japanese coastal waters during the northern winter months of January-April. The NSW sightings were concentrated on the continental slope between 34°-37°S and *B. bairdii* concentrate on the continental slope of eastern Japan between 34°-38°N (Kasuya, 1971).

McCann (1975) considered that *B. arnuxii* approached the coastal waters of New Zealand in the summer months to breed. AEP is experienced in identifying calves and estimating the lengths of other cetaceans (Paterson, 1982) but did not identify calves in the schools observed off NSW.

CONCLUSION

The evidence concerning *B. arnuxii* so ably assembled and presented by McCann (1975) together with the observations of Balcomb (1989) in Antarctica and the data for *B. bairdii* support the likely identity of the NSW ziphiids as *B. arnuxii*. It is admitted that the absence of a specimen introduces tantalising uncertainty and that the estimated lengths of these ziphiids include species other than *B. arnuxii*. Future aerial and shipboard studies may result in more precise photo-identification and skin biopsy for DNA evaluation.

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FIG. 6. Four large ziphiids at 34°38'S, 151°16'E on 19 January 1984. Possible anterior convex configuration of blow hole (arrows).

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